EXECUTIVE SUMMARY of
1. World Robotics 2010 Industrial Robots
2. World Robotics 2010 Service Robots

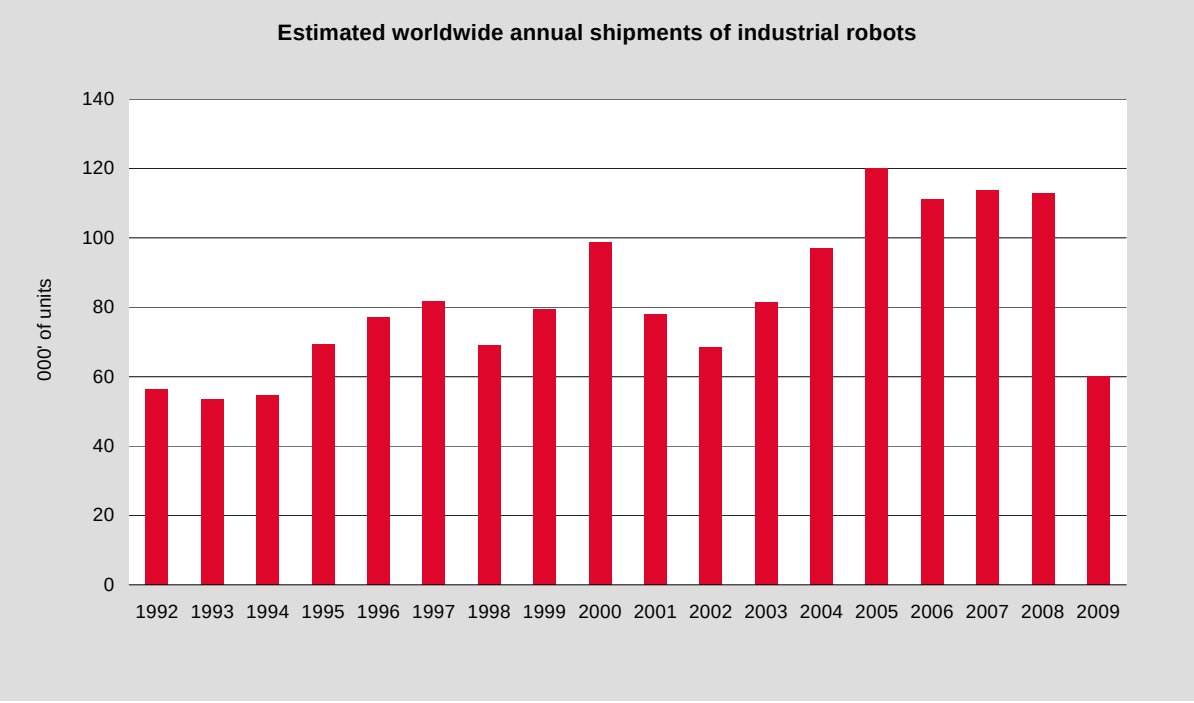
1. World Robotics 2010 Industrial Robots

Sales slump in 2009

In 2009, the worldwide economic and financial crisis caused a significant slump in the sales of industrial robots. Compared to 2008, considered one of the most successful years, 2009 had a decline of 47% (60,000 units). This is the lowest level reported since 1994. Robot installations had never decreased so heavily.

In recent years, various regions have concluded different outcomes. In 2009, all regions saw a significant decline of robot installations. About 30,100 industrial robots (50% less than in 2008) were supplied to **Asian** countries, Australia and New Zealand. The main market, Japan, nosedived by almost 62%. **Japan** has seen a continuing decline in robot investments since 2006. After strong investments of about 44,000 units in 2005, and a cyclical decline in 2006 and 2007, a substantial cut in robot investments in 2008 and in 2009 to about 12,800 units followed. Almost all industries cut investments in robot installations widely. The total supply in 2009 was the lowest since the early eighties.

The second largest robot market in Asia, the **Republic of Korea**, saw a substantial decrease of robot supplies after considerable growth in 2008, from 11,600 units to 7,800 units. Even **China**, the most rapidly growing robot market in the world in the past few years felt the effects of the crisis as well as India. Robot sales in China fell by 30% to 5,500 units. India, still a rather small but promising robot market saw a decline of almost 60% to 360 units. Robot supply to all other Asian markets also fell significantly, except for Singapore where more units were installed than in India in 2009. Robot sales to Australia also fell while an increase in the small robot market of New Zealand has been registered.



In 2009, robot shipments to the Americas dropped by 48% from 17,200 units to 9,000 units. Already in 2008, robot sales to the **United States** – by far the largest robot market in the Americas - and **Canada** decreased. Both countries were strongly affected by the cyclical recession which began at the end of 2007 and the collapse of the financial markets which followed in the autumn of 2008. Almost all industries were affected by the economic crisis, but the automotive industry was hit the hardest. Overcapacities, shrinking demand, the wrong model policy and the financial crisis affected the automotive industry substantially in North America. Production capacities have been cut or relocated. Investments in new industrial robots were completely down in the first half of 2009. The robot shipments to the United States and Canada slowly started to increase as of the 3rd quarter in 2009. But the number of units was still far away from that of the most successful years, 2005 to 2007. In the **United States,** robot shipments slumped by 49% to about 6,800 units in 2009 compared to 2008. In **Canada**, the shipments fell by 72% to about 500 units**.**

Robot shipments to **Mexico** slightly increased in 2009 to 1,100 units. European and Asian motor vehicle suppliers ordered industrial robots to increase their capacities. Mexico started to gain importance as a production site for the automotive industry for financial reasons. Robot supplies to **Argentina and Brazil** also fell substantially.

Sales of industrial robots in **Europe** dropped by 41% to 20,500 units, the lowest number of robots since 1997. Between 2005 and 2008, a strong trend towards automation boosted robot sales. This trend has been stopped due to the economical downturn in 2008/2009. Almost all industries significantly reduced robot investments, predominantly the automotive industry which has been concentrating on restructuring.

After the three years of continued growth and a peak of 15,100 units in 2008, the robot supplies nosedived in **Germany** by 44% to 8,507 units in 2009. Particularly, the main customers – automotive, metal and rubber and plastic - cut their investments heavily. However, there was an increase or only a moderate decrease of robot supplies to industries which still buy considerably low quantities: the food and beverage industry, the glass, ceramics and stone industry, the semiconductor industry, and the medical devices industry.

In 2009, total sales in **Italy** – the second largest robot market in Europe - were down by 40%, to about 2,900 units following a decreasing trend since 2007. Its economy was feeling the pinch due to the declining export markets and a decreasing domestic demand. Therefore, investments were down and all the main industries significantly reduced production in 2008 and again in 2009. In 2009, 1,450 industrial robots were sold in **France**, 44% fewer than in 2008. This was the lowest number of installations since 1995. Sales to Spain were down by 41% to 1,350 units. The shipments to the UK also decreased by 26% to some 600 units. All three countries are important automotive production sites and since 2006, the robot installations were decreasing.

The economical downturn as well as the decreasing or stagnating car market in Western Europe in the past few years revealed the existing overcapacities in the region. While Germany is hardly affected by the restructuring of the automotive industry, all other production sites in Western Europe saw a continued decline of investments of the automotive industry as a whole already between 2005 and 2008.

Robot sales to the **Central/Eastern European** countries dropped by 44%. Only the shipments to the Russian Federation increased, but the number of units is still rather low.

Robot investments were cut in almost all industries

In 2009, the **automotive industry** – the most important purchaser of industrial robots - accounted for 36% of the **total year's supply**. In 2009, world-wide shipments slumped by 52% compared to 2008. With regard to Australia, China, India, Thailand, Taiwan and other Asian countries the distribution by industries is not complete. But, considering that most of these countries are emerging markets in the automotive industry, the real share of the automotive industry is higher. Given the distribution by application, it can be concluded that the supply to the automotive industries in China, Thailand, Malaysia and India also decreased in 2009.

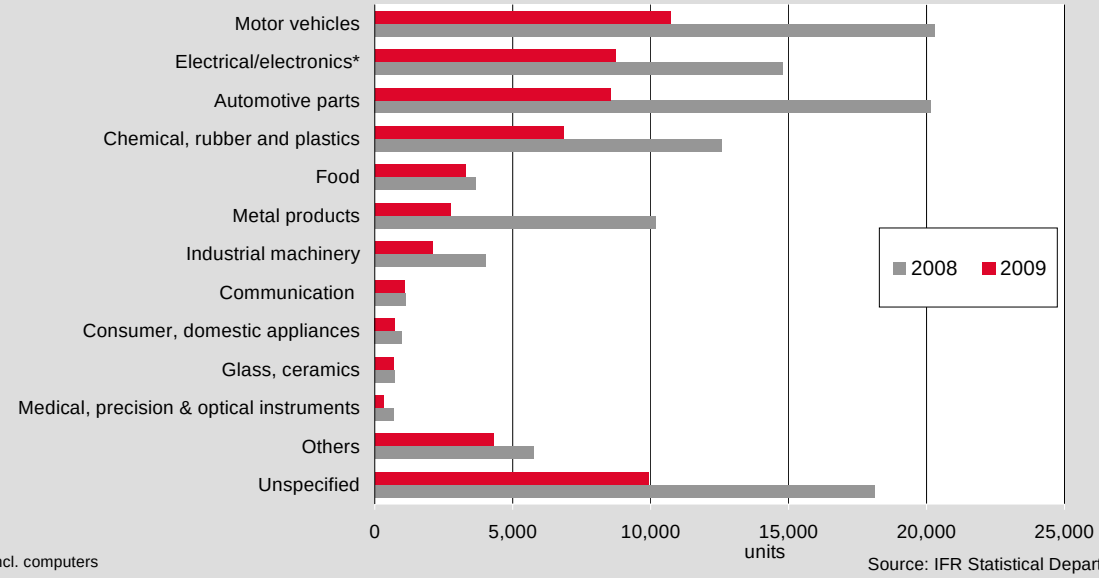
After strong investments in robots in 2004 and 2005 in the **electrical/electronics industry** worldwide (including computers and equipment, radio, TV and communication devices and equipment, and

medical, precision and optical instruments), installations slowed down between 2006 and 2008. In 2009, the robot investments were down by 34% to 10,855 units accounting for a share of 18%.

After years of continuing growth, the **rubber and plastics industry** reduced robot investments in 2008 and 2009 from the peak level of about 15,000 units to 5,800 units, accounting for a share of 10% of the total supply in 2009. Robot supplies to the pharmaceuticals and cosmetics industry were growing up to 2008. In 2009, the robot sales only slightly decreased to 1,044 units. This industry was hardly affected by the economic downturn. The **food and beverage industry** decreased robot orders by 10% to almost 3,300 units, accounting for a share of 5% of the total supply. About 60% of the worldwide sales to this industry were made in Europe.

Sales to the **metal and machinery industry** dropped by 64% to 5,253 units and a share of 9% of the total supply in 2009. Regarding the machinery industry, there were no separate data available for North America. Therefore, this sector is included in metal products. Until 2008, robots supplies to the metal and machinery industry as well as to the food and beverage industry were continuously growing.

Estimated worldwide annual supply of industrial robots at year-end by industries 2008 - 2009



*incl. computers

Source: IFR Statistical Department

Operational stock of industrial robots decreased in 2009

Total accumulated yearly sales, measured since the introduction of industrial robots in industry at the end of the 1960s, amounted to more than **2,230,000 units** at the **end of 2009. This includes, as mentioned before, the dedicated industrial robots installed in Japan up to and including 2000** (see the tables in annex A). Many of the early robots, however, have by now been taken out of service. The stock of industrial robots in actual operation is therefore lower. Based on the assumptions made in chapter I, IFR estimates,

the total worldwide stock of operational industrial robots at the end of 2009 was in the range of 1,021,000 and 1,300,000 units.

The minimum figure above is based, as was discussed in chapter I, on the assumption that the average length of **service life is 12 years**. A UNECE/IFR pilot study has indicated that the average service life might in fact be as long as **15 years**, which would then result in a **worldwide stock of 1,300,000 units**.

Due to the tremendous decrease of robot installations in 2009, for the first time the minimum stock of 1,021,000 units in 2009 was about 1% lower than the stock of the year before.

Value of the market decreased to $3.8 billion

In 2009, the value of sales of industrial robots converted in US$ decreased by 39% to US$3.8 billion. It should be noted that the figures cited above generally do not include the cost of software, peripherals and systems engineering. This may result in the actual robotic systems market value to be about two or three times as large. The world market for robot systems in 2009 is therefore estimated to be $12 billion.

High potential for robot installations in the “general industry”

When comparing the distribution of multipurpose industrial robots in various countries, the robot stock, expressed in the total number of units, can sometimes be a misleading measure. In order to take into account the differences in the size of the manufacturing industry in various countries, it is preferable to use a measure of robot density. One such measure of robot density is the number of multipurpose industrial robots per 10,000 persons employed in manufacturing industry or in the automotive industry or in the “general industry” (which is all industries excluding the automotive industry).

Following the IFR calculations only Japan has a relatively high degree of robot density in the general industry. But it must be pointed out, that this high degree is mainly influenced by the robot units installed in the electronics industry. So there is still a potential for robot installations in other sectors. In Germany, Korea, Sweden and Finland the robot density in the general industry is already at a considerable level but can still increase. Taking into account the size of a country and the size of their manufacturing industry the potential is very high in USA, Canada, Korea, Brazil, most of the Western European countries and predominantly in China. Almost all industries are investing in the promising consumer market of the Peoples Republic of China. On a more long term prospect, Russia and India, the two increasingly growing consumer markets, will provide a tremendous potential for robot installations. The demand for quality and productivity is also rising in the so called low-wage countries, such as the Eastern European or the South East Asian countries. Furthermore, the wages in these countries are expected to rise.

Just a calculation: The estimated average robot density in the total manufacturing industry in the world is between 50 and 100. In order to increase this density to about 200, between 1.2 million and 1.5 million new robots will have to be installed.

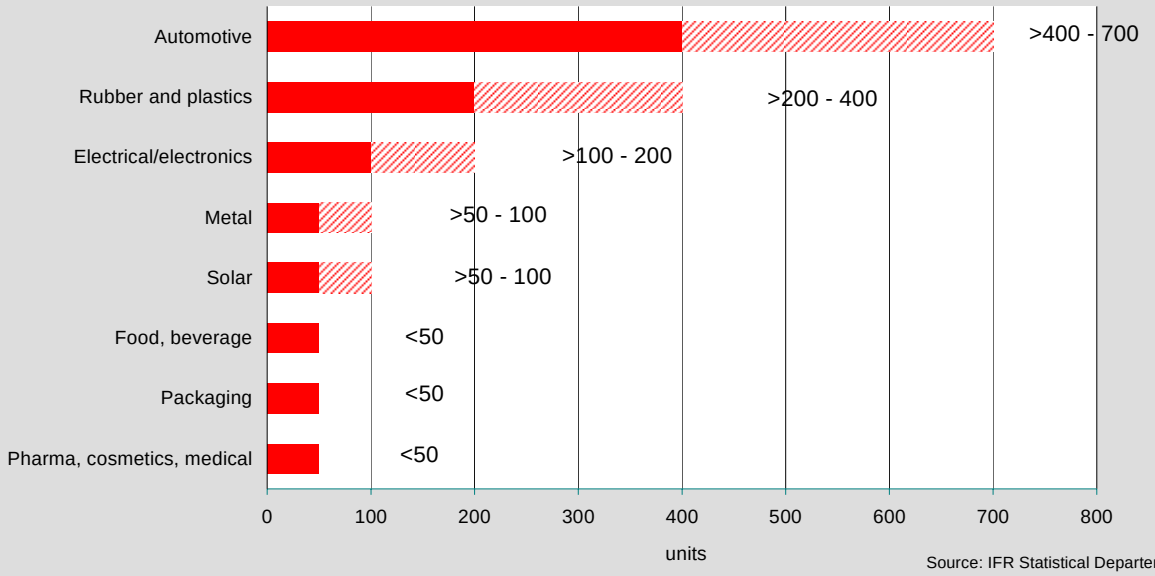
Strong recovery in 2010, continued growth between 2011 - 2013

A strong recovery of worldwide robot installations in 2010 will result in an increase of about 27% to about 76,000 units. The main impulses are coming from China, the Republic of Korea and other South-east Asian countries. But the robot supplies to Japan and North America will also substantially increase. In Japan robot sales were decreasing since 2006. In North America sales already declined in 2008. In Europe, the recovery has a slow pace and is mostly based on the exports. The domestic demand is still weak although major investments in capacities and modernization took place between 2005 and 2008. Robot sales continuously increased between 2005 and 2008.

The main driver of the recovery is the automotive industry which has restarted to invest in new technologies, further capacities and renovation of production sites. The General Industry - all other industries, except automotive – already increased its robot investments between 2005 and 2008. This will continue between 2010 and 2013. The trend towards automation was stopped by the economic crisis in 2009. The IFR conducted a study on the worldwide automation potential requested by the Messe Munich. The number of robots in operation per 10,000 employees in various industry sectors and countries were evaluated (robot density). The results show a tremendous potential for industrial robots especially in growing industries, such as the pharmaceuticals and cosmetics industry, medical devices industry and the

food and beverage industry. However, in the metal industry and the solar industry the robot applications are still far behind that of the automotive industry.

Figure IV.3: Estimated number of operating industrial robot by 10,000 persons employed



Source: IFR Statistical Departement

But there are more reasons for a bright future in robotics: Huge consumer markets are opening up in China, India, Brazil and Russia. The competitive nature of the automotive companies results in new investments in production facilities in these markets. Other industries are following as well. The degree of automation in North America is comparatively low with a need to catch up through investments in robotics. Companies in high-wage and in low-wage countries have to reduce costs and guarantee high quality to remain competitive on the world market. The Middle Eastern countries are becoming new markets for automation.

After the substantial rise of robot sales in 2010, a further increase will resume in the period between 2011 and 2013 about 10% per year on average attaining a level of more than 100,000 units. In the Americas sales will be up by 33% in 2010, **in Asia/Australia** by 34% and **in Europe** by 12%. Between 2011 and 2013, robot shipments will increase by about 9% per year on average in the Americas, about 12% in Asia/Australia and by 8% in Europe.

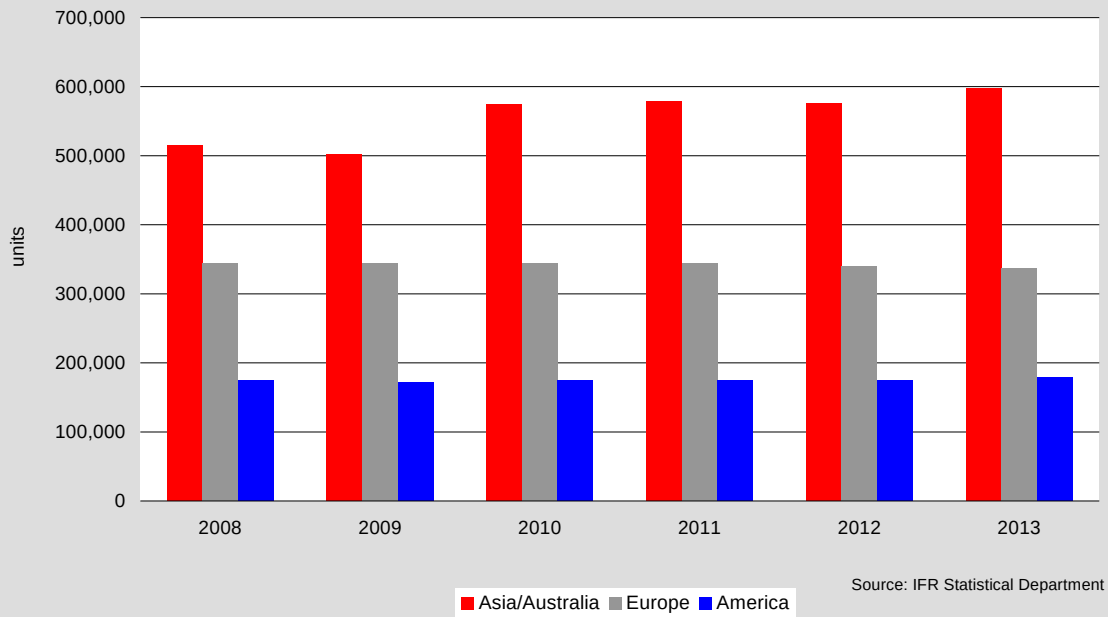
Table 1

Shipments and operational stock of multipurpose industrial robots Number of units

	Yearly installations			Operational stock at year-end		
Country	**2009**	**2010**	**2013**	**2009**	**2010**	**2013**
America	**8,917**	**11,900**	**15,300**	**172,141**	**174,600**	**178,700**
North America (Canada, Mexico, USA)	8,417	11,000	13,500	166,183	167,800	169,100
Central and South America	500	900	1,800	5,958	6,800	9,600
Asia/Australia	**30,117**	**40,500**	**57,100**	**501,422**	**574,000**	**597,900**
China	5,525	8,500	16,500	37,312	45,800	84,500
India	363	600	1,500	4,079	4,700	8,100
Japan	12,767	17,000	21,000	332,720	315,900	263,700
Republic of Korea	7,839	9,800	12,000	79,003	87,400	109,800
Taiwan	1,474	2,000	2,800	24,365	25,600	31,000
Thailand	774	1,000	1,400	7,185	8,200	11,900
Other Asia	866	1,600	1,900	10,061	86,400	88,900
Australia/New Zealand	509			6,697		
Europe	**20,483**	**23,000**	**29,100**	**343,661**	**344,400**	**337,200**
Benelux	1,286			11,678		
France	1,450	1,700	2,000	34,099	34,200	29,500
Germany	8,507	10,000	12,600	144,133	144,200	143,300
Italy	2,883	2,900	4,200	62,242	60,800	54,500
Spain	1,348	1,500	1,800	28,781	28,500	24,900
Sweden	587			9,396		
United Kingdom	635	650	900	13,923	13,300	10,800
Central/Eastern European countries	1,448			10,268		
other Europe	2,339	6,250	7,600	29,141	63,400	74,200
Africa	**196**	**300**	**500**	**1,973**	**2,300**	**3,300**
Total	**60,018**	**76,000**	**102,300**	**1,020,731**	**1,097,100**	**1,119,800**

Source: IFR, national robot associations

Figure IV.2 Estimated operational stock of industrial robots 2008-2009 and forecast for 2010-2013



2. World Robotics 2010 Service Robots

Service robots for professional use: 76,600 units sold up to the end of 2009

With 23,200 **units** the service robots in **defense applications**, accounted for 30% of the total number of service robots for professional use sold up to the end of 2009. Thereafter follow field robots (mainly **milking robots**) with 25%, **cleaning robots** and **medical robots** with 8% each and **underwater systems** with 7%. **Construction and demolition robots** and **mobile robot platforms for general use** (6%, each) **logistic systems** (5%) **and rescue and security applications** (4%) come in the next ranges. Minor installation numbers were counted for inspection systems and public relation robots.

The **total value** of professional service robots sold up to the end of 2009 was $13.2 billion.

Service robots for personal and private use: about 5.6 million units for domestic use and about 3.1 million units for entertainment and leisure sold up to end of 2009

Service robots for personal and domestic use are recorded separately, as their unit value generally is only a fraction of that of many types of service robots for professional use. They are also produced for a mass market with completely different pricing and marketing channels.

So far, service robots for personal and domestic use are mainly in the areas of **domestic (household) robots**, which include vacuum cleaning and lawn-mowing robots, and **entertainment and leisure robots**, including toy robots, hobby systems and education and training robots.

The market for **robots for handicap assistance** is still small, but is expected to increase substantially in the next 10 years. Robots for **personal transportation** and **home security and surveillance robots** will also increase in importance in the future.

In 2009, about one million **vacuum cleaning robots** were sold, 7% fewer than in 2008. More than 26,000 **lawn mowing robots** were sold in 2009.

Projections for the period 2010-2013: 80,000 new service robots for professional use to be installed

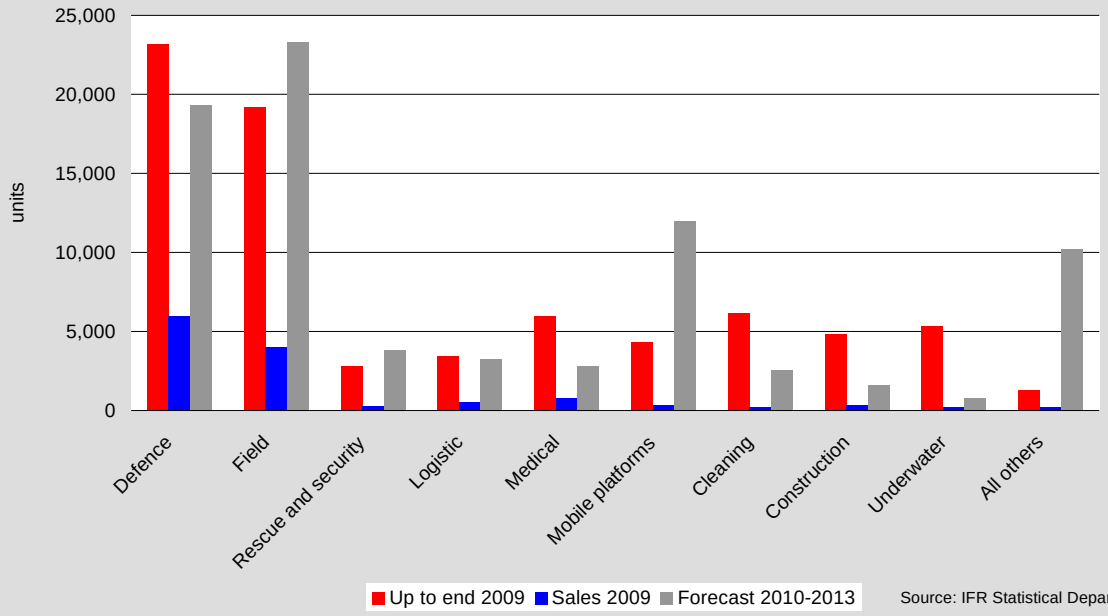
Turning to the projections for the period 2010-2013, the stock of service robots for professional use is forecast to increase to some 80,000 units. Application areas with strong growth are **defence, rescue and security applications**, **field robots**, **logistic systems**, **inspection robots, medical robots** and **mobile robot platforms for multiple use**.

Projections for the period 2010-2013: about 11.4 million units of service robots for personal use to be sold

It is projected that sales of **all types of domestic robots** (vacuum cleaning, lawn-mowing, window cleaning and other types) in the period 2010-2013 could reach some **6.7 million units**.

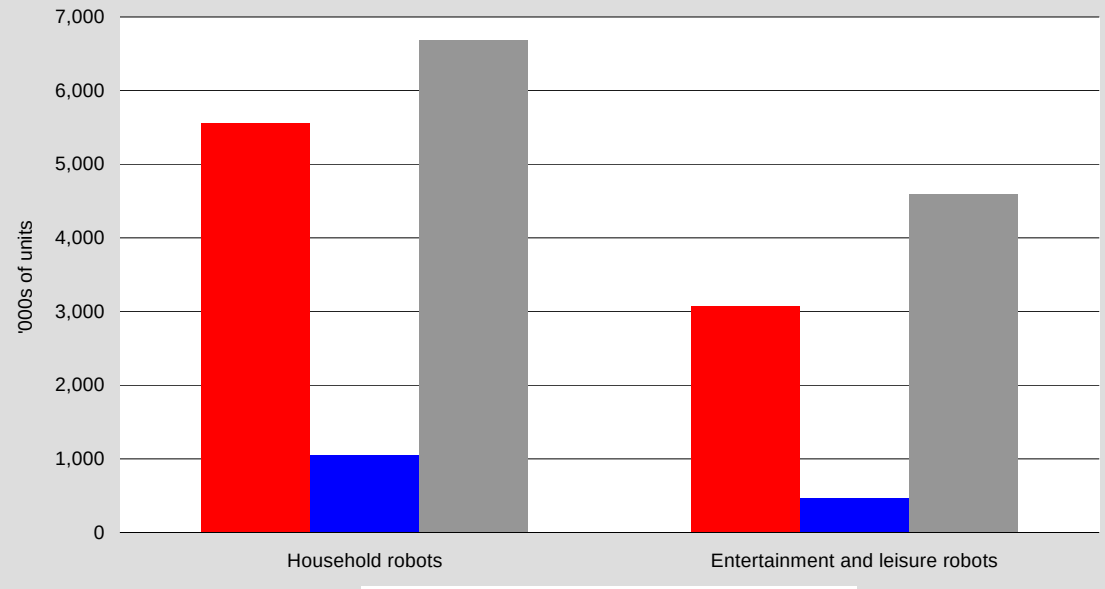
The market for **entertainment and leisure robots**, which includes toy robots, is forecast at about **4.6 million units**, most of which, of course, are very low cost.

Figure II.1a Service robots for professional use.
Sold units up to the end of 2009, sold units 2009 and forecast 2010-2013



Source: IFR Statistical Departement

Figure II.2a Service robots for personnel/domestic use.
Sold units up to the end of 2009, sold units 2009 and forecast 2010-2013



Source: IFR Statistical Departement